Joint Transportation Research Program

Principal Investigator: Rebecca S. McDaniel, Purdue University, rsmcdani@purdue.edu, 765.463.2317

Program Office: jtrp@purdue.edu, 765.494.6508, www.purdue.edu/jtrp

Sponsor: Indiana Department of Transportation, 765.463.1521

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Development of a Friction Performance Test for Compacted Asphalt Mixtures

Introduction

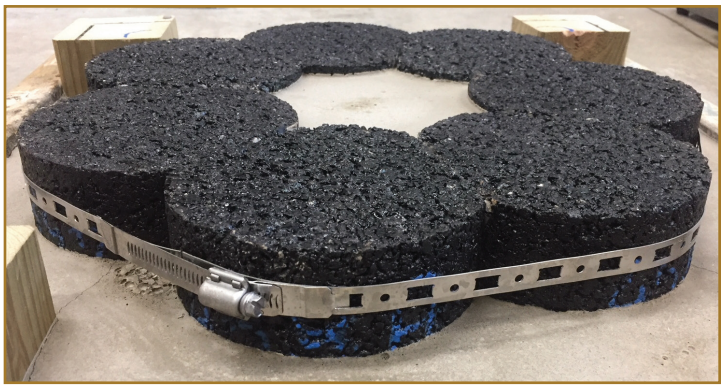
In a previous JTRP project published in 2010, *Identification of Laboratory Techniques to Optimize Superpave HMA Surface Friction Characteristics*, a laboratory procedure to polish and test the frictional properties of asphalt mixtures was developed. Subsequently, the procedure has been used in other research efforts to evaluate the frictional properties of recycled asphalt pavement (RAP) and local (possibly marginal) aggregate blends and for other testing purposes. Most notably, the procedure has been developed into Indiana Test Method (ITM) 221, "Acceptance Procedures for HMA Surface Mixture Coarse Aggregates for ESAL ≥ 10,000,000." The method requires compaction, polishing and testing of 500 mm by 500 mm (20 in. by 20 in.) square slabs of asphalt mix.

This research project was initiated to explore the possibility of expanding use of the lab polishing/testing procedure to test gyratory specimens or field cores. It was envisioned that such a method could be used during mix design as a check on potential frictional properties and/or as a quality acceptance test.

Findings

A method for fabricating test rings composed of cylindrical specimens was developed. Samples of five plant-produced mixes were tested in various forms—slabs such as those used in ITM 221, gyratory pills compacted from loose plant mix, quality control pills compacted by the contractors and field cores. The results led to the following findings.

- Proof of concept testing indicated it might be feasible to test cylindrical specimens instead of slabs of asphalt mix; this was confirmed by additional testing.
- A reliable way of fabricating test rings using cylindrical samples was developed and used successfully throughout the remainder of this research project. A minimum of four gyratory specimens or seven field cores is required.
- No differences were observed between the tops and bottoms of gyratory specimens and no aggregate breakage had occurred; therefore, it is reasonable to saw gyratory specimens in half and test both the top and bottom surfaces (not the cut surfaces); this reduces the number of gyratory pills needed for testing.
- The comparison of lab-compacted pills and test slabs from the spray paver project, compacted to similar air void levels, showed good agreement. This suggests it is reasonable to test gyratory specimens instead of slabs.
- Comparison of field cores and lab-compacted samples from three lots of a 12.5-mm SMA exhibited slightly greater differences in texture and friction than some of the other comparisons. The reasons for this are not obvious, and the differences may be normal variation. This suggests the need to further analyze variability between repli-



Cores secured in testing ring

cate samples of given mixtures to determine the acceptable tolerance.

- Differences in the texture depth for a given mixture do not have as great an impact on friction as differences between mixtures, such as aggregate type or gradation or binder content (if excessive). Therefore, differences between lab and field compaction do not appear to negatively impact the validity of the proposed test method.
- Comparison of four different types of samples of a 9.5-mm SMA (slab, lab-compacted, QC pills and field cores) showed similar textures for the lab-compacted pills, QC pills and slab; the cores had lower texture. Despite the difference in texture, the friction levels after polishing were comparable, reinforcing the lesser impact of texture of friction (for the same aggregates and mix).
- Testing field cores allows consideration of the effects of construction on the final product.
- Insufficient time has elapsed since the tested mixes were placed in the field for any conclusions to be drawn about the relationship between the lab and field results, though previous experience shows that ITM 221 was able to predict field friction trends. Field friction on the tested mixes should be monitored for at least two years.
- Based on research, testing experience and specification changes since ITM 221 was developed, changes to the test method were proposed and implemented.

In conclusion, the proposed test method appears to be promising. The proposed method is faster than the current method because fabricating slabs is somewhat time consuming. Less material is required since the gyratory pills are much smaller; the slab configuration requires material inside and outside the testing path that is never tested. Gyratory compaction allows greater control of the air void content than slab compaction, although air voids do not appear to have a great impact on the measured friction levels, within the range tested.

Implementation

Changes have already been made to ITM 221 as a result of discussion with this project's Study Advisory Committee; additional changes have been proposed to allow testing cylindrical samples. A new test method has been proposed for consideration by INDOT that would allow testing gyratory pills as a go/no go check on mix friction during mix design. Field cores could be tested as a quality acceptance test during construction. Shadow testing on several projects is recommended to gain more experience with the test method before widespread implementation. Additionally, lower friction mixtures need to be tested to determine specification limits.

Recommended Citation for Report

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